



PETROBRAS

# OCS Advisory Offshore Workshop

## The Development of Cascade and Chinook Fields in Ultra Deep Waters of the Gulf of Mexico

César Palagi  
Walker Ridge Asset Manager  
Petrobras America Inc.  
January 20<sup>th</sup>, 2010



PETROBRAS

# Agenda

## 1 - Introduction

## 2 - Cascade and Chinook Framework

- Ownership and Well History
- GoM Environment and Regulation

## 3 - Cascade and Chinook – Phase 1

- Overview and Timeline
- Reservoir and Wells
- Subsea, FPSO and Export System

## 4 - Path Forward



PETROBRAS

# Agenda

## 1 - Introduction

## 2 - Cascade and Chinook Framework

- Ownership and Well History
- GoM Environment and Regulation

## 3 - Cascade and Chinook – Phase 1

- Overview and Timeline
- Reservoir and Wells
- Subsea, FPSO and Export System

## 4 - Path Forward



PETROBRAS

# Petrobras Summary

- Proven Reserves (SPE): 15 bi boe
- Employees: 74,000
- O&G Production: 2.6 million boe/day
- Refining Throughput: 2.1 million boe/day

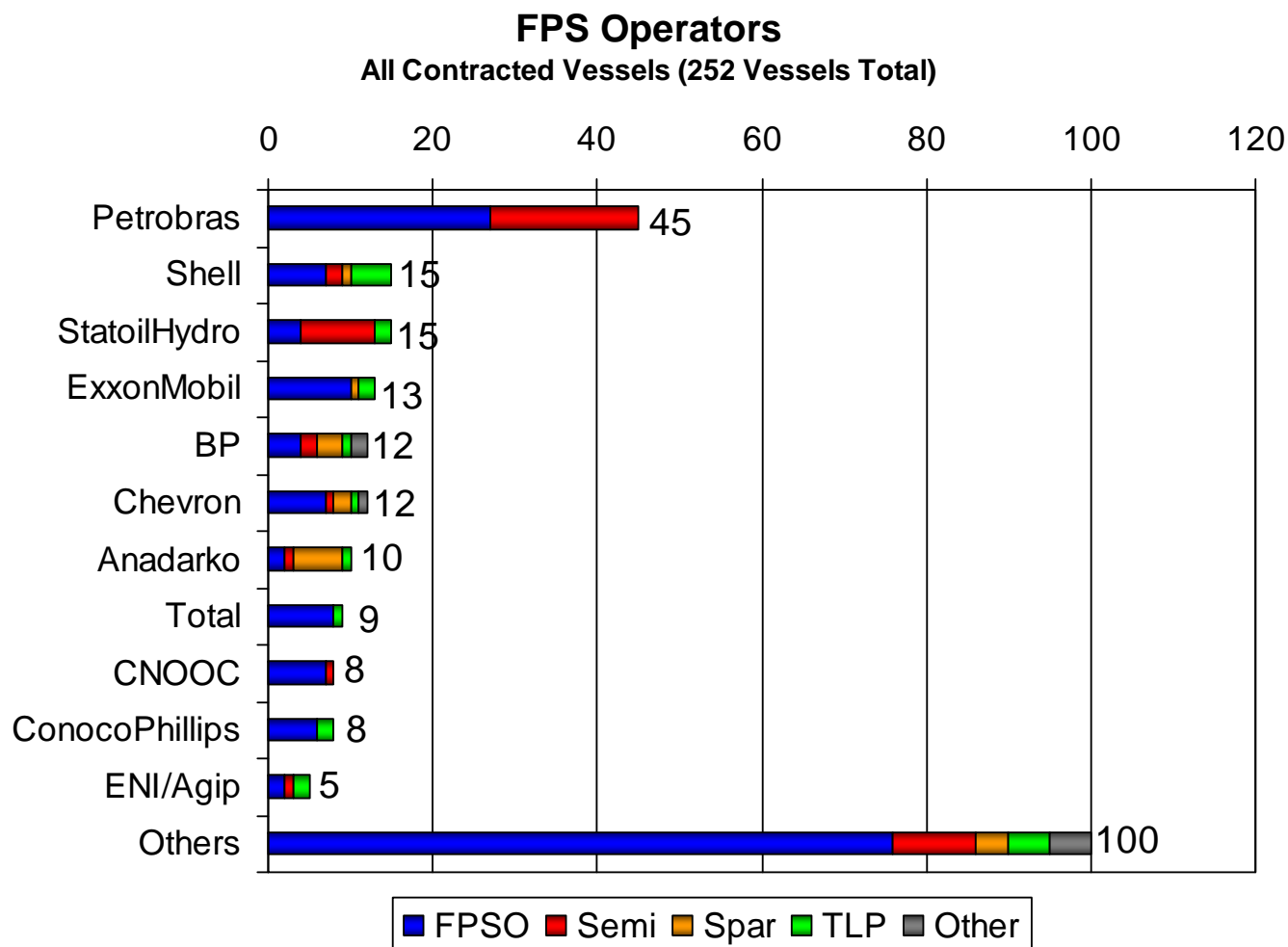


● HEAD OFFICE  
■ DOWNSTREAM

■ TRADING  
■ E&P

■ GAS & POWER  
■ REPRESENTATIVE OFFICE

# Petrobras as an Operator of Floating Production Systems





PETROBRAS

# Agenda

## 1 - Introduction

## 2 - Cascade and Chinook Framework

- Ownership and Well History
- GoM Environment and Regulation

## 3 - Cascade and Chinook – Phase 1

- Overview and Timeline
- Reservoir and Wells
- Subsea, FPSO and Export System

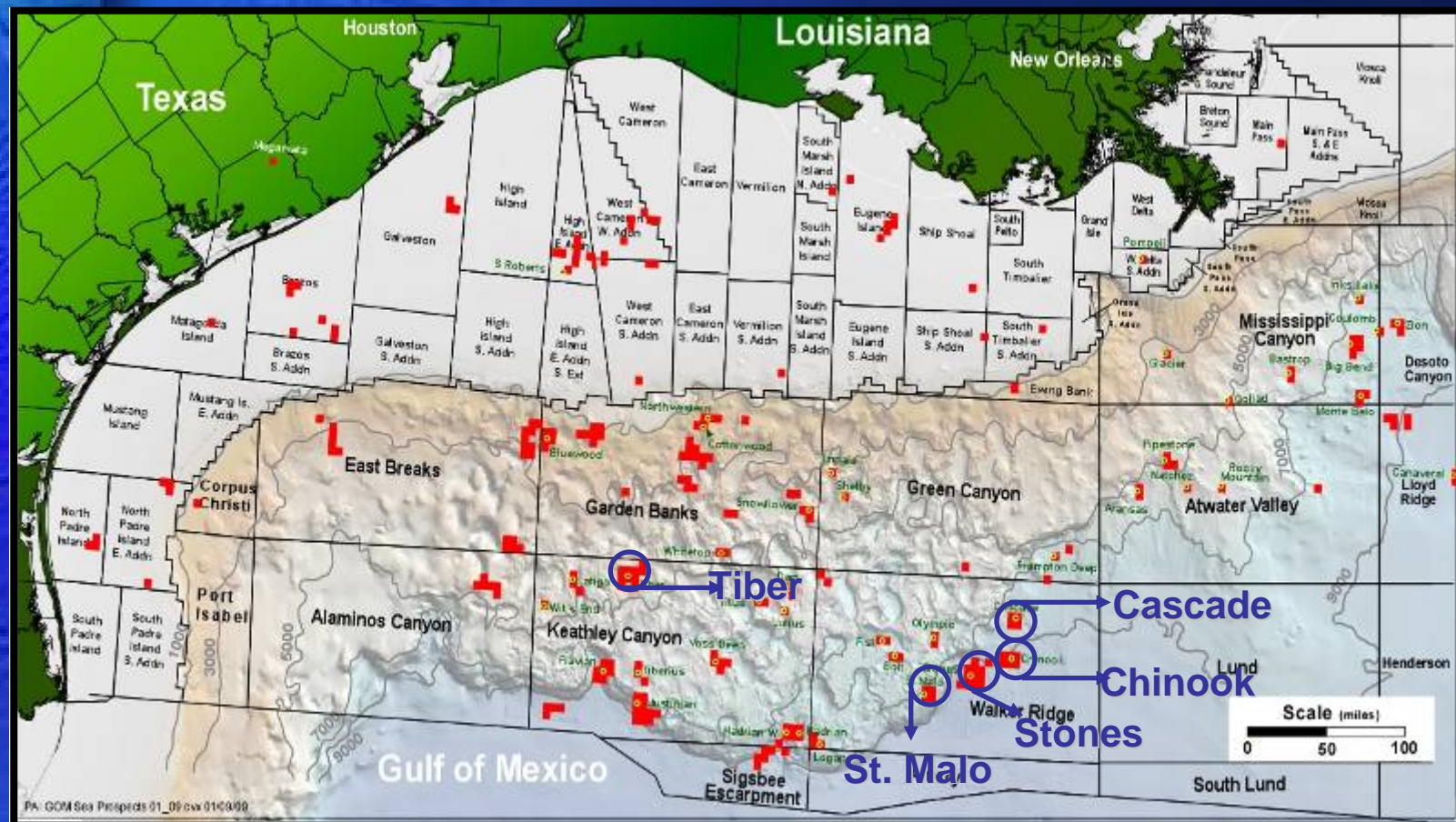
## 4 - Path Forward





PETROBRAS

# Petrobras E&P Portfolio in Gulf of Mexico





PETROBRAS

# Cascade and Chinook Field History (1996 Lease Sale)

Year	Cascade	Chinook
<b>2002</b>	1 Discovery Well	
<b>2003</b>		1 Discovery Well
<b>2004</b>		
<b>2005</b>	2 Appraisal Wells	
<b>2006</b>	Petrobras took Operatorship	
<b>2007</b>		
<b>2008</b>		
<b>2009</b>	2 Wells	





PETROBRAS

# Cascade and Chinook Lease Holders

## The Cascade Field

### Lease Holders

- Petrobras – 50%
- Devon – 50%

(Blocks WR205, 206,249 &250)

## The Chinook Field

### Lease Holders

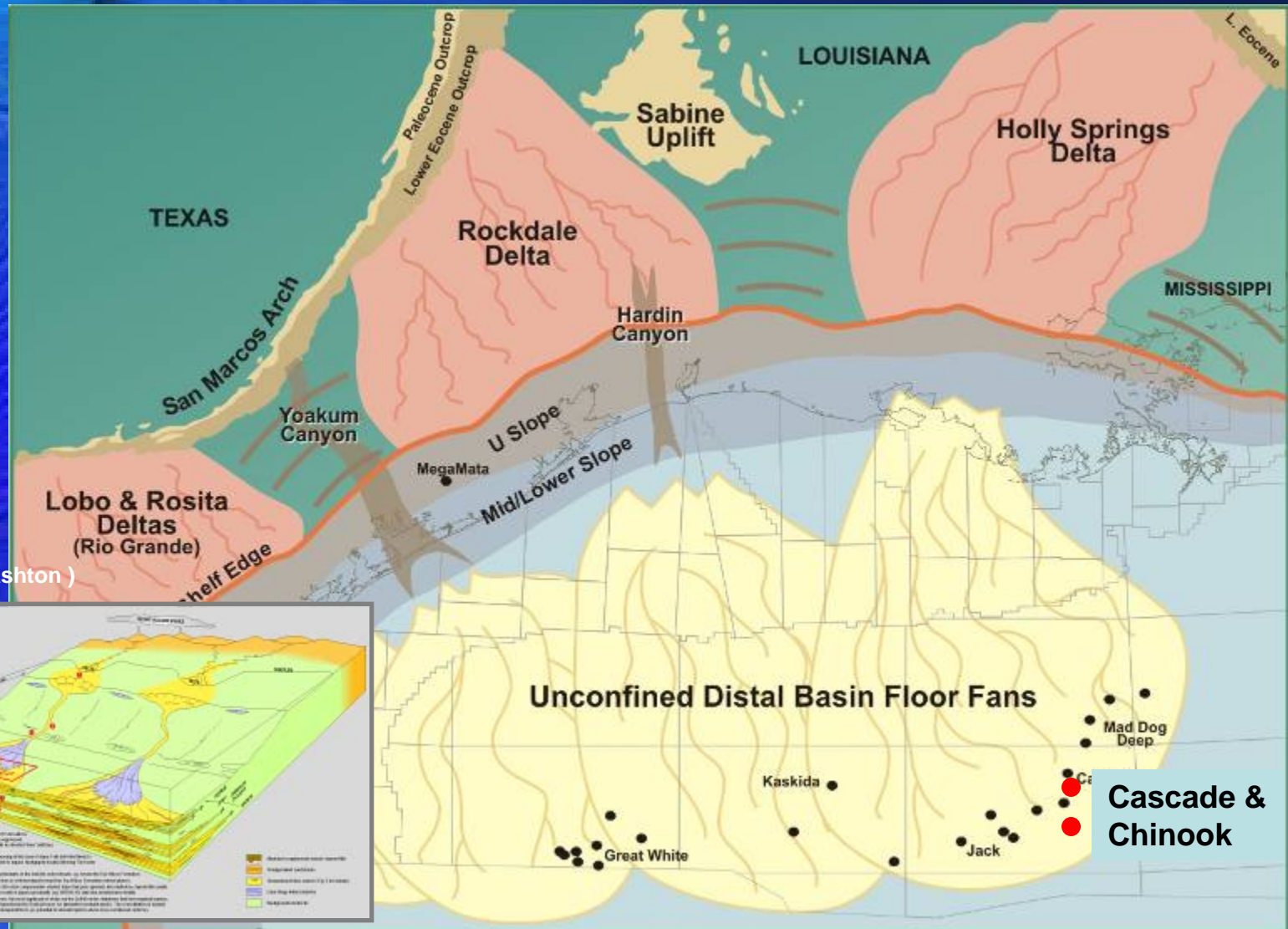
- Petrobras – 66.67%
- Total – 33.33%

(Blocks WR 425,426,469&470)



PETROBRAS

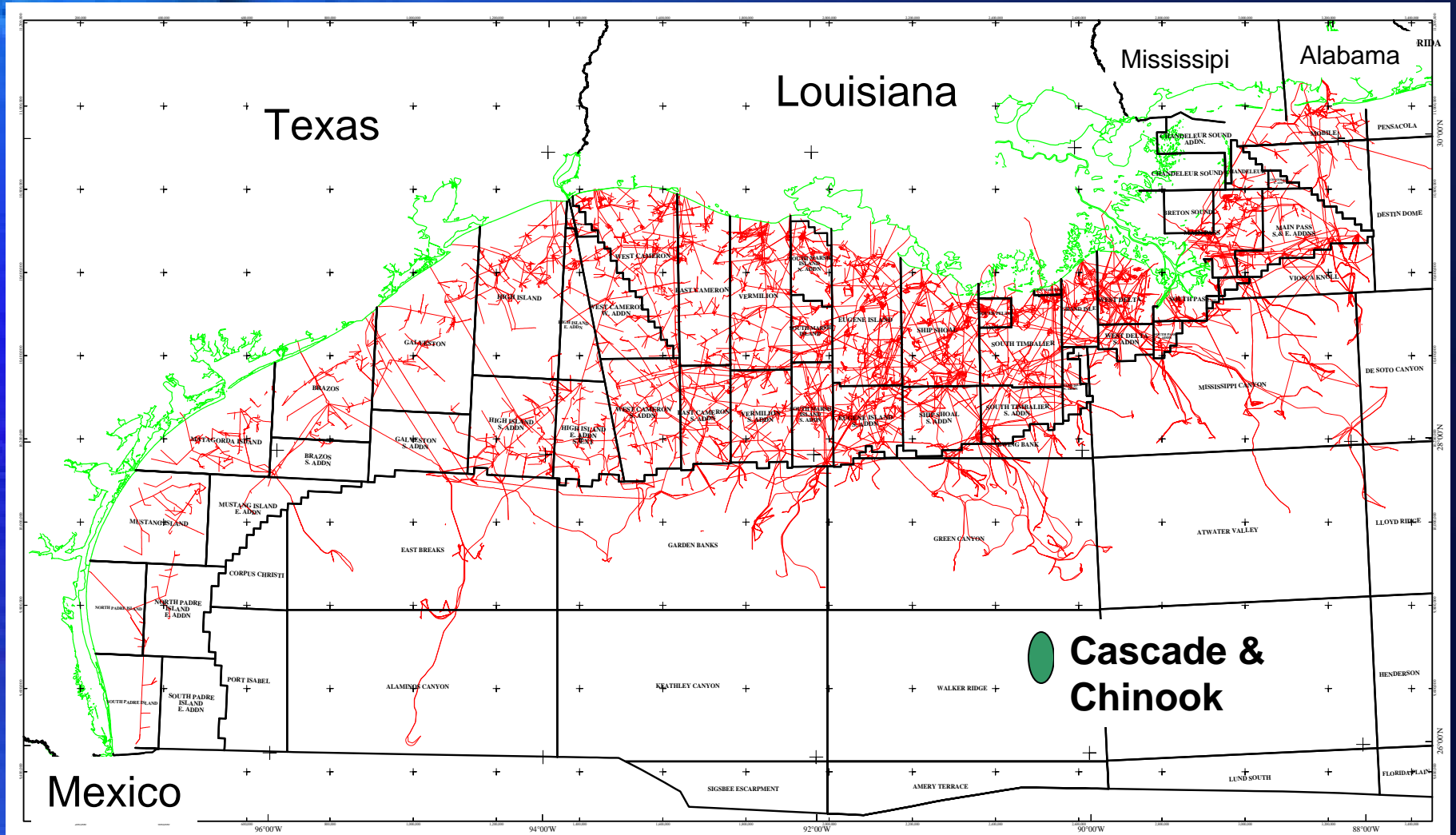
# Lower Tertiary in GoM Depositional Environment



Modified 5/8/07 from Galloway, et al 2000



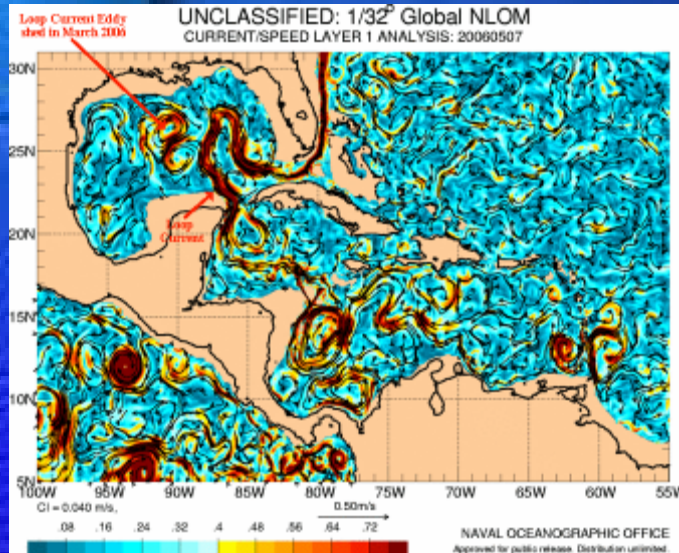
# Oil and Gas Pipelines in Gulf of Mexico



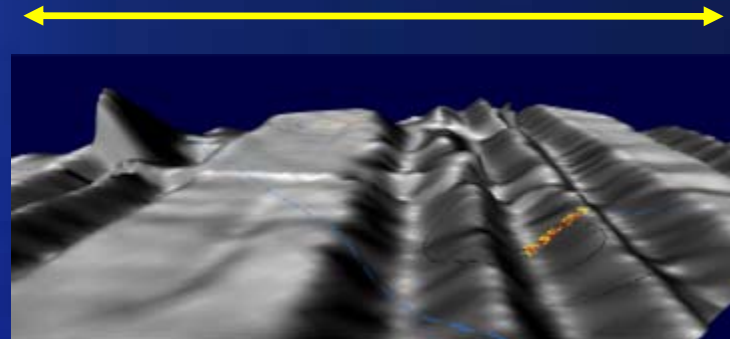
# Currents, Furrows and Hurricanes in Gulf of Mexico



PETROBRAS



~1 Football Field







PETROBRAS

# Regulatory Compliance

## MMS

Exploration Plan  
Application for permit to Drill  
Conservation Information Document  
Downhole Commingling  
D.W.O.P.  
D.O.C.D.  
Pipeline Application / ROW & LT  
Riser Verification (CVA – Risers)  
Structural verification (Structural CVA)  
Production Safety System  
Surface Commingling & Measurement  
Well Control & Production Training  
In-Service Inspection Plans  
Oil Spill Response  
NPDES  
Departure Requests  
MMS Inspections incl. Pre-Production Inspection

## USCG

Certificate of Compliance (COC)  
Foreign Flag Issues & Equivalencies  
Design Document & Plan Review  
Manning & Licensing  
Security / Safety Zone  
Lightering Procedure  
Oil Spill Management  
Emergency Evacuation Plan / Vessel Response Plan  
In-Service inspection plan  
USCG Inspections During Construction & Installation  
Pre-COI / COC Inspection



PETROBRAS

# Agenda

## 1 - Introduction

## 2 - Cascade and Chinook Framework

- Ownership and Well History
- GoM Environment and Regulation

## 3 - Cascade and Chinook – Phase 1

- Overview and Timeline
- Reservoir and Wells
- Subsea, FPSO and Export System

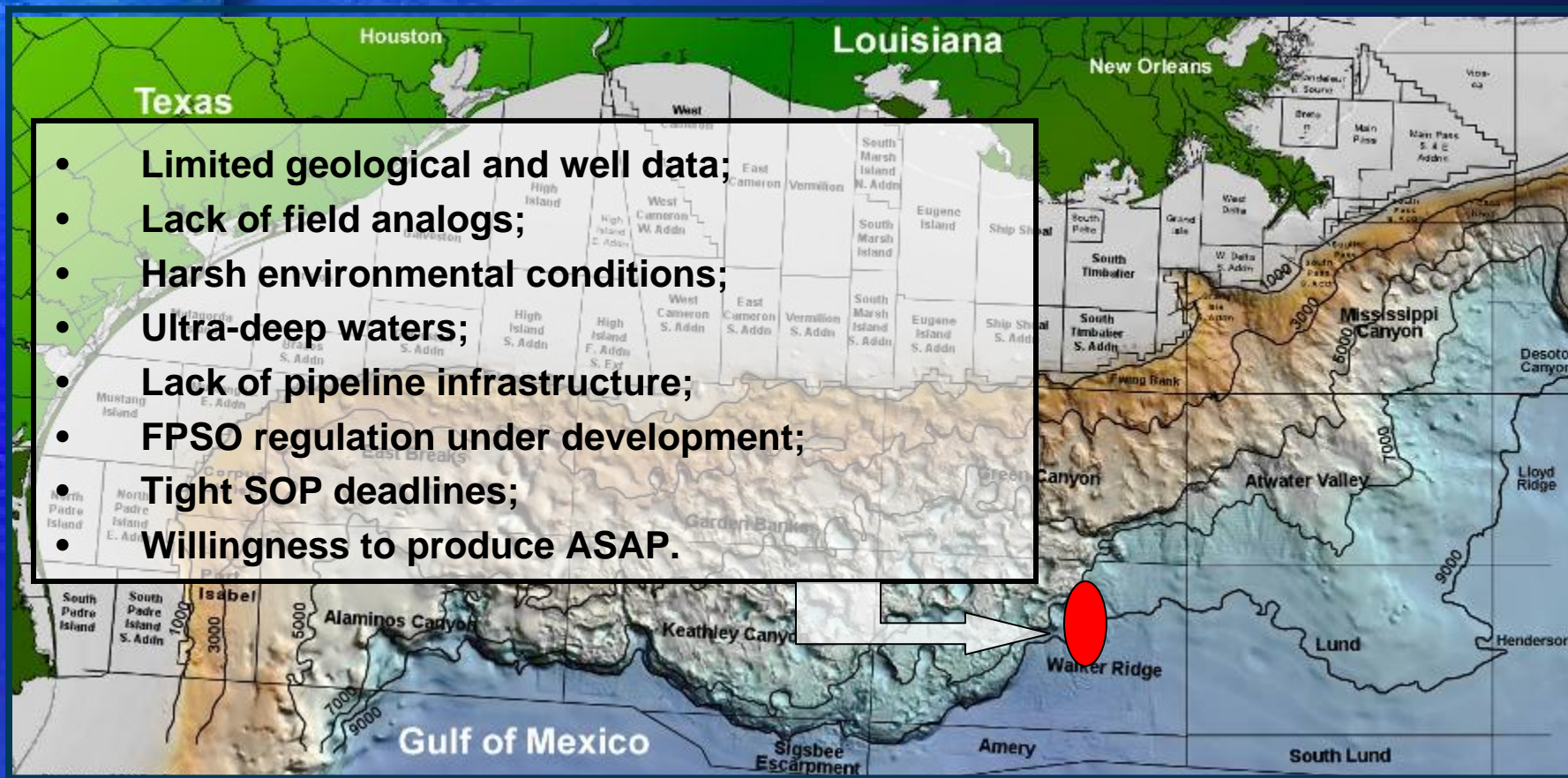
## 4 - Path Forward



PETROBRAS

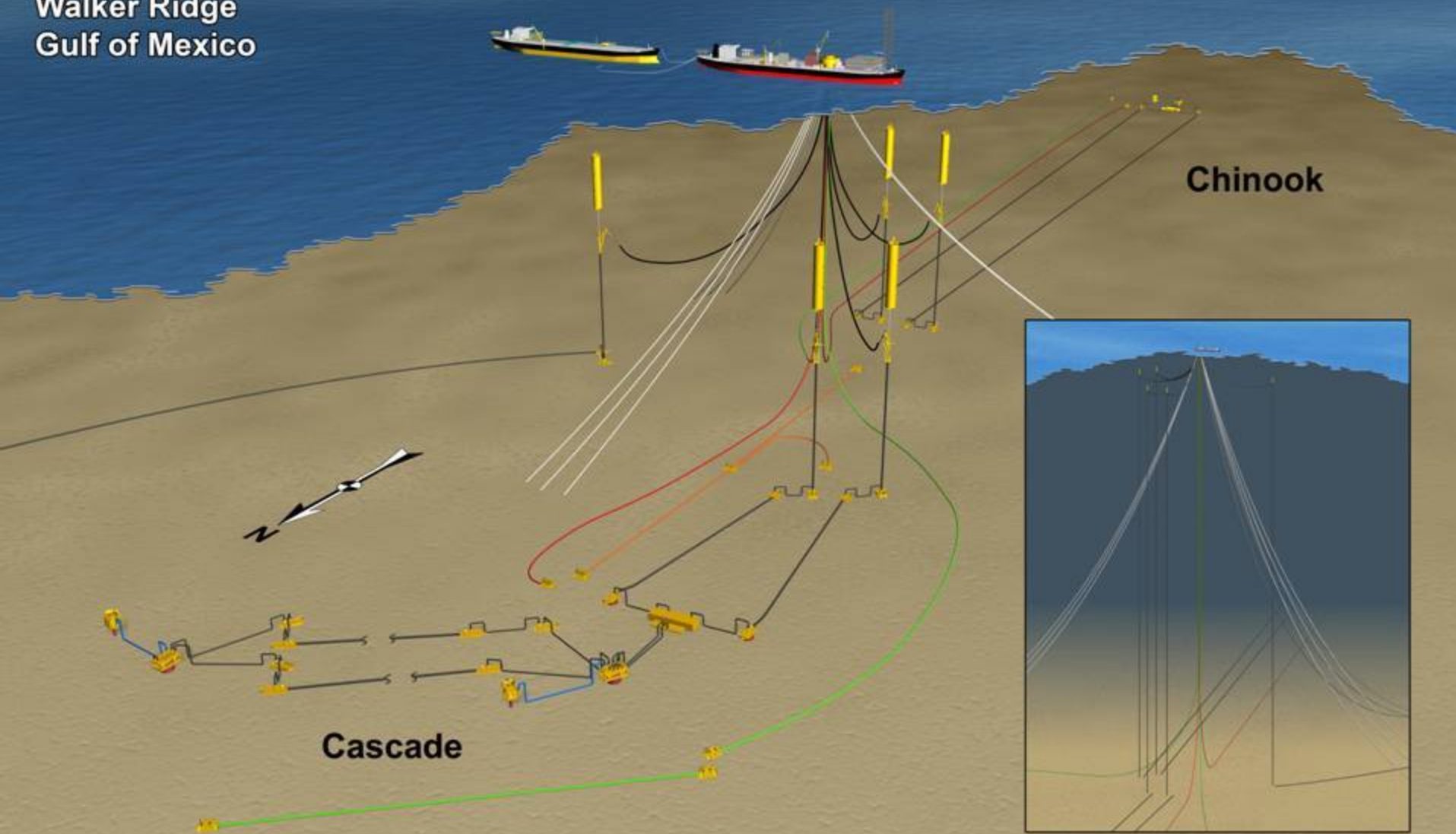
# Cascade and Chinook We Were Here in Aug/2006

- Limited geological and well data;
- Lack of field analogs;
- Harsh environmental conditions;
- Ultra-deep waters;
- Lack of pipeline infrastructure;
- FPSO regulation under development;
- Tight SOP deadlines;
- Willingness to produce ASAP.





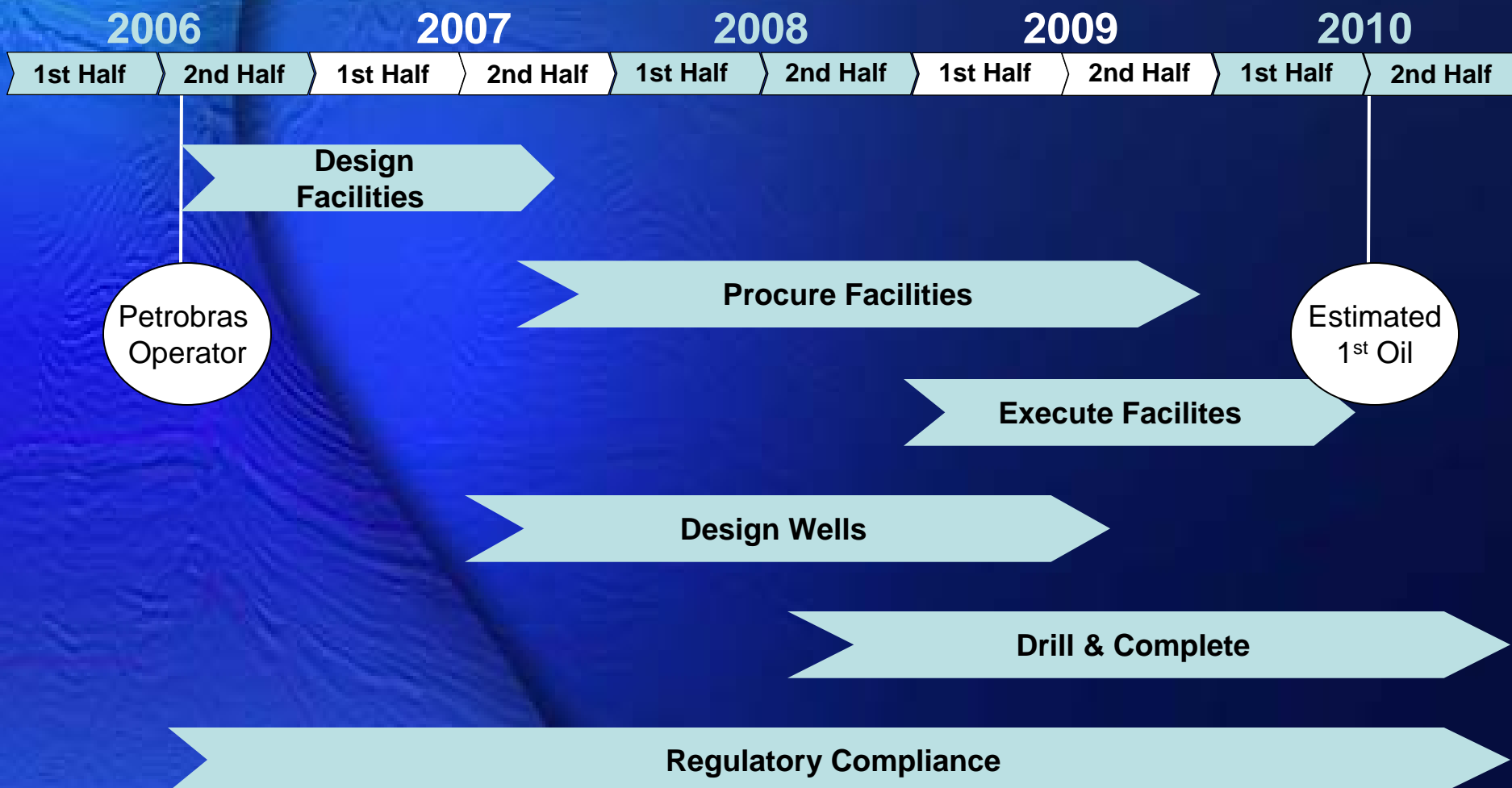
Cascade and Chinook Phase I  
Walker Ridge  
Gulf of Mexico





PETROBRAS

# Project Schedule



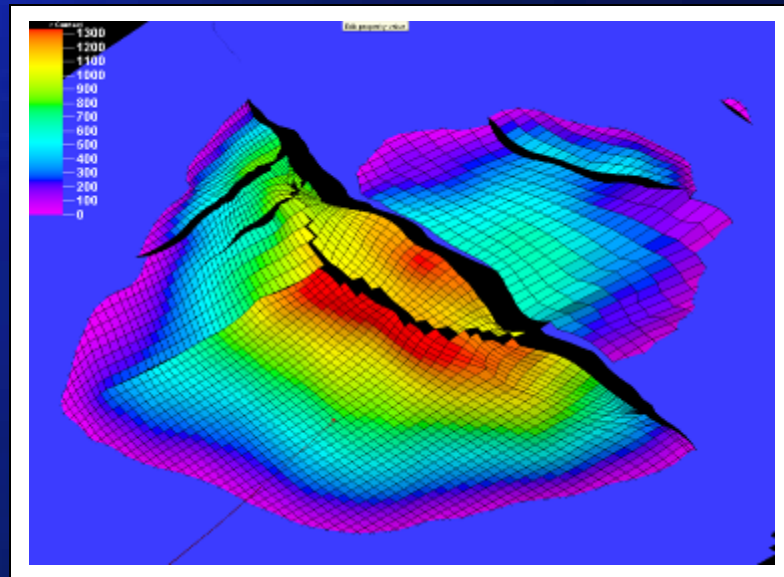
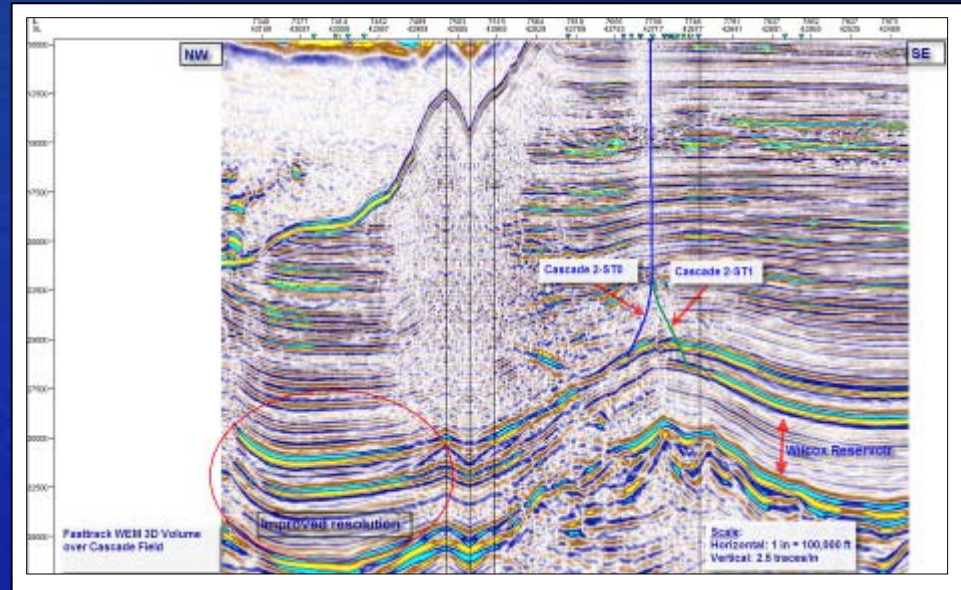


# Reservoir Challenges

PETROBRAS



Seismic Vessels







PETROBRAS

# Cascade and Chinook Rigs 1/2

2008



**Ocean Endeavor - 10,000 ft WD**  
( Under Contract to  
Devon Energy )  
Diamond Offshore Drilling

2008



**West Sirius - 10,000 ft WD**  
( Under Contract to  
Devon Energy )  
Seadrill Limited



PETROBRAS

# Cascade and Chinook Rigs 2/2

2009/2010



**Discover Deep Seas**  
**10,000 ft WD**  
**(Under Contract to Chevron)**  
**Transocean Ltd.**

2010

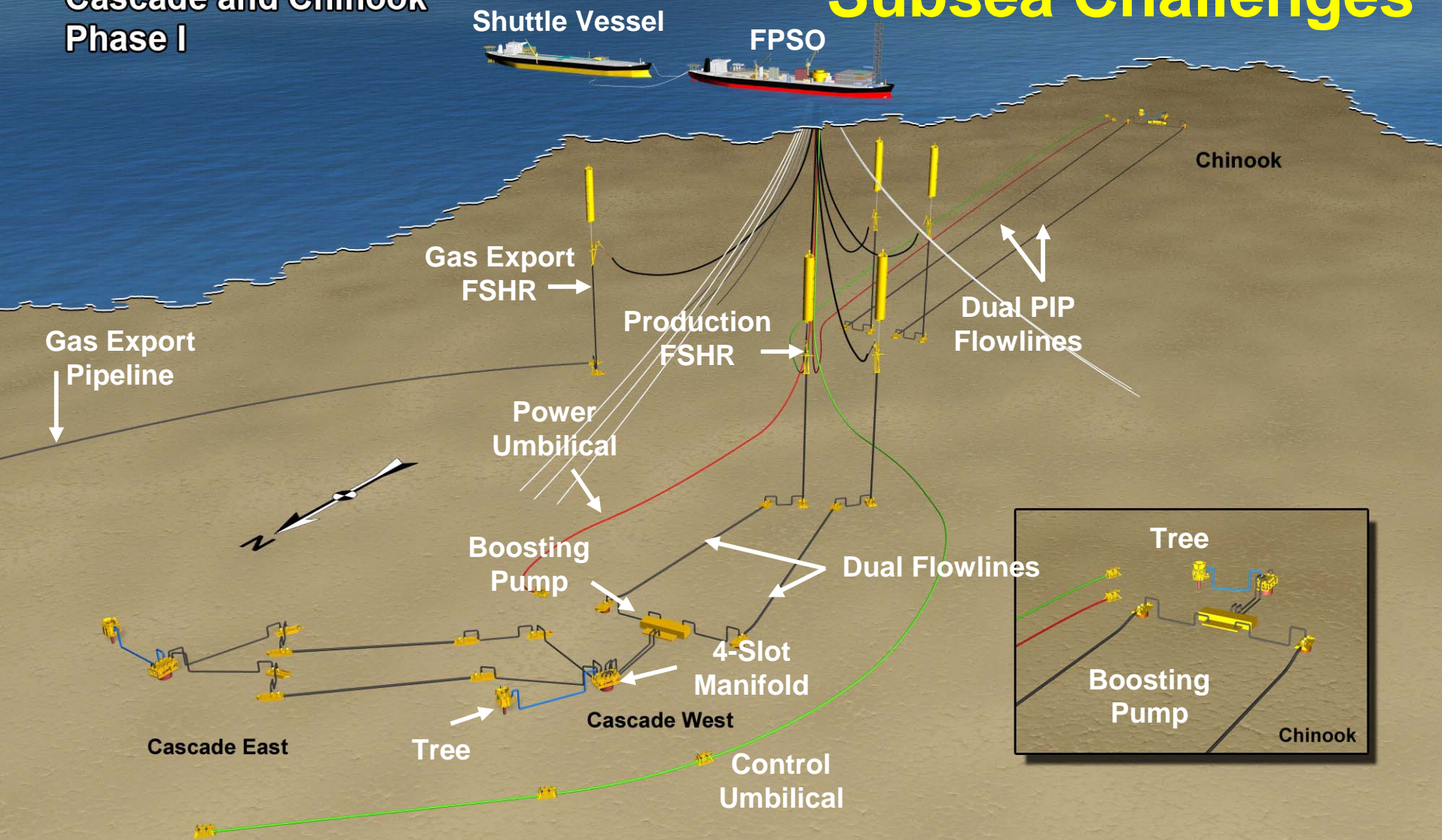


**Ocean Courage**  
**10,000 ft WD**  
**(New Built)**  
**Diamond Offshore Drilling**



# Cascade and Chinook Phase I

# Subsea Challenges





PETROBRAS

# Subsea Risers and Equipment



Tree & Manifolds: Houston



Riser Can: Finland



Technip Deep Blue





PETROBRAS

# Pipe-in-pipe Installation



**Pipe-in-pipe: Mexico  
and Alabama**



**Heerema Balder**



PETROBRAS

# Umbilical Construction and Installation



**Umbilical: Alabama**

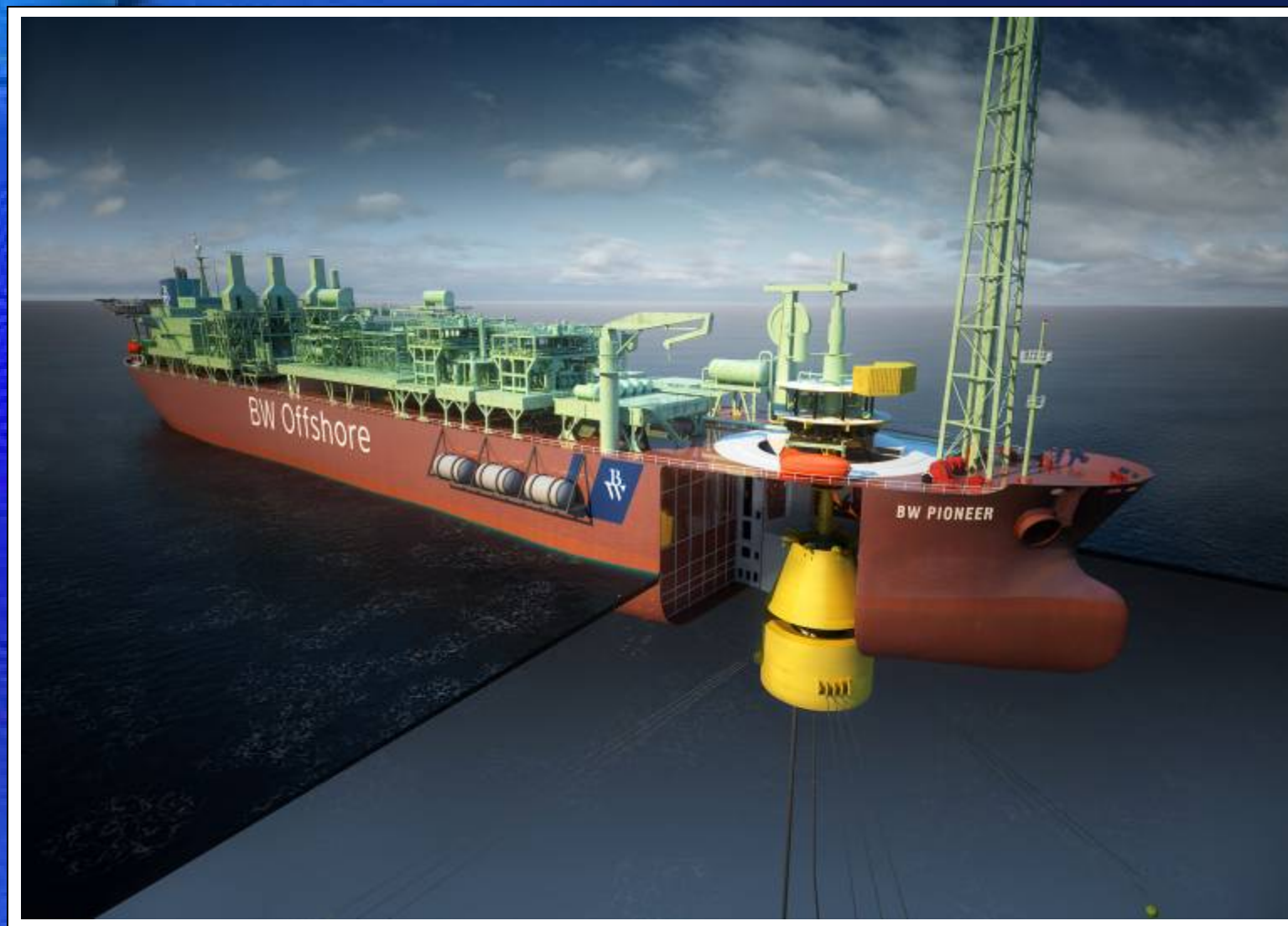


**Subsea 7 Seven Seas**



PETROBRAS

# FPSO and Shuttle Challenges







# FPSO Construction in Singapore



Module Lift onto FPSO



Aboard the FPSO at  
Keppel Shipyard,  
Singapore

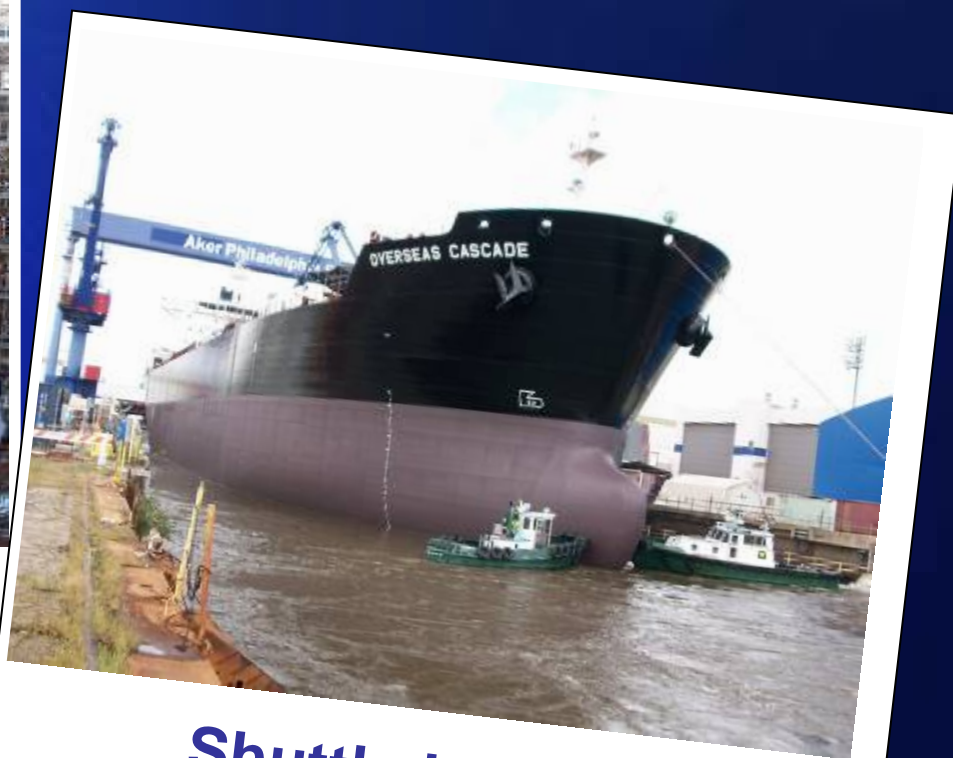


PETROBRAS

# Shuttle Tanker Construction in Philadelphia



**Shuttle: Philadelphia**



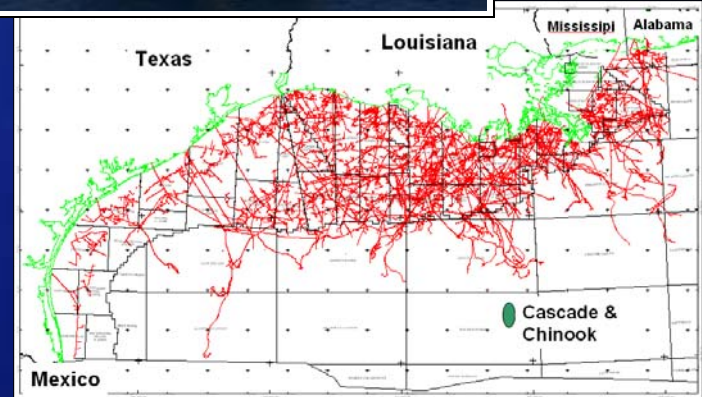
**Shuttle Launching**



# FPSO & Shuttle vs. Non-storage FPU & Oil Pipeline



PETROBRAS



## FPSO & Shuttle Advantages:

- No need for pipeline infrastructure.
- Can be redeployed elsewhere.
- Last out and first in operations during storms.

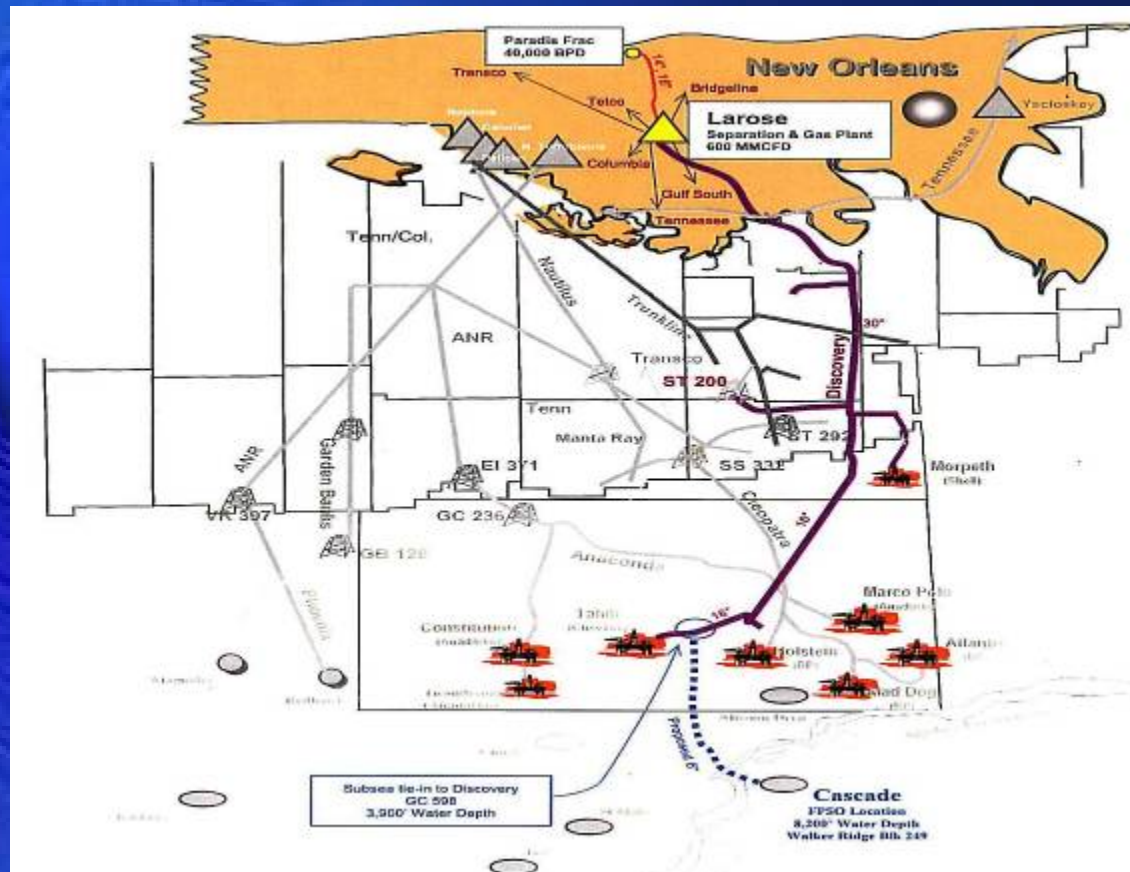
## TLP/SS/SPAR & Oil Pipeline Advantages:

- Friendlier to subsea risers.
- Allow DVA rigs and/or dry X-tree.
- Well defined industry and regulation in GoM.



PETROBRAS

# Gas Export Discovery Pipeline System







PETROBRAS

# Cascade and Chinook Project Worldwide Construction Sites



**Equipment and Services  
from over 20 Countries**



PETROBRAS

# Nationalities of the Walker Ridge Team

## 21 Countries



**One Project...**  
**... 21 Nations**



PETROBRAS

# Agenda

## 1 - Introduction

## 2 - Cascade and Chinook Framework

- Ownership and Well History
- GoM Environment and Regulation

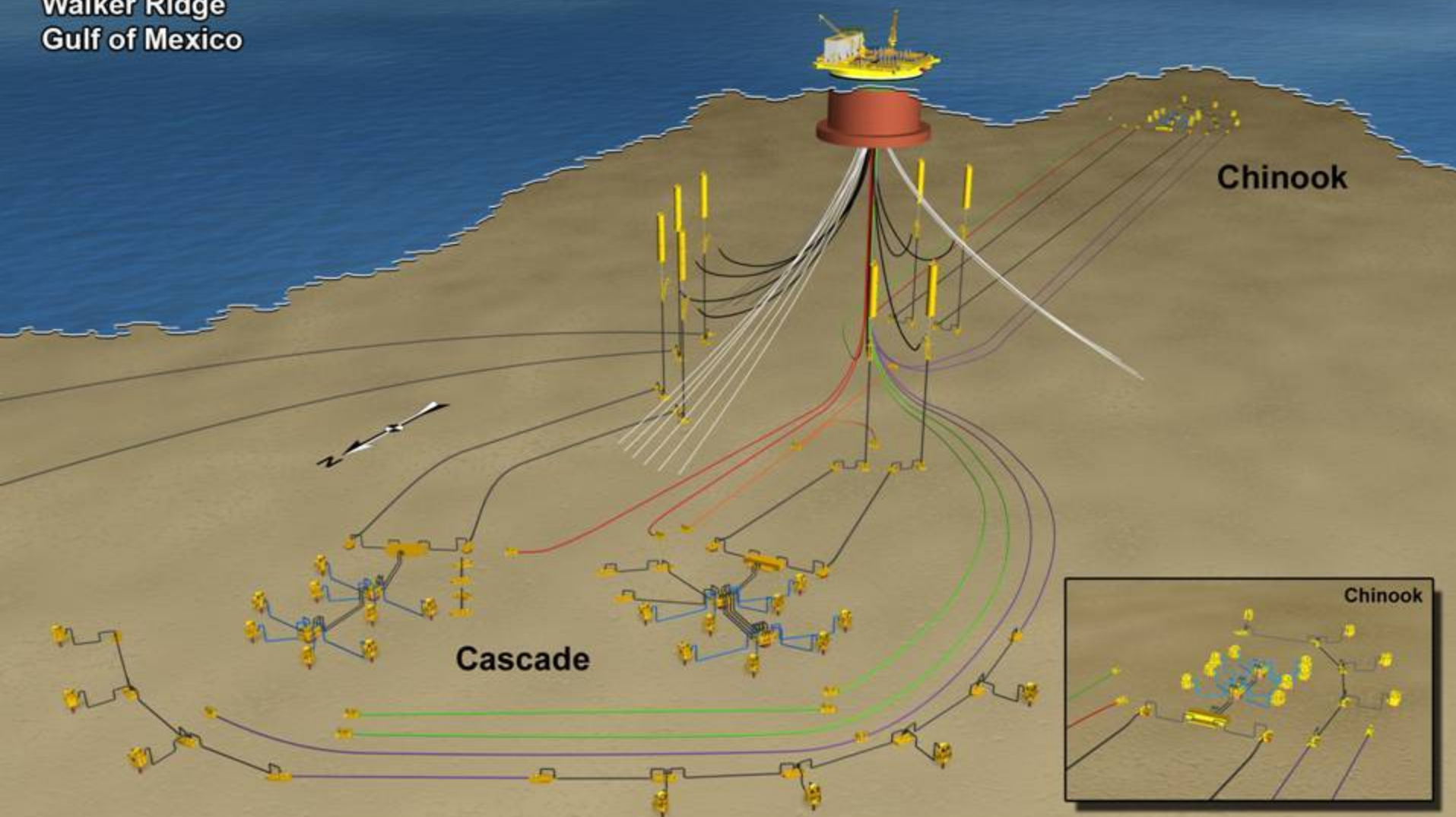
## 3 - Cascade and Chinook – Phase 1

- Overview and Timeline
- Reservoir and Wells
- Subsea, FPSO and Export System

## 4 - Path Forward

# Cascade and Chinook Phase III

Walker Ridge  
Gulf of Mexico





PETROBRAS

# Final Message

- The Cascade and Chinook project will pave the way for future ultra-deep water Lower Tertiary fields in the US GoM.





PETROBRAS

# OCS Advisory Offshore Workshop

## The Development of Cascade and Chinook Fields in Ultra Deep Waters of the Gulf of Mexico

César Palagi  
Walker Ridge Asset Manager  
Petrobras America Inc.  
January 20<sup>th</sup>, 2010